

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant(s):	W.F. MICKA et al.	Examiner	Jonathan A. Barton
Serial No.	10/674,845	Group Art Unit	2186
Filed	September 29, 2003	Docket No.	TUC920030100US1
TITLE	METHOD, SYSTEM, AND PROGRAM FOR MIRRORING DATA AMONG STORAGE SITES		

CERTIFICATE UNDER 37 CFR 1.8:

I hereby certify that this correspondence is being transmitted through the USPTO EFS-Web system via the Internet to Jonathan A. Barton of the U.S. Patent and Trademark Office on April 4, 2006.

/David Victor/
David W. Victor

AMENDMENT

Commissioner for Patents
P.O. Box 1450
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Dear Sir:

This paper is submitted in response to a first non-final office action in the above case dated January 4, 2006, in which the Examiner rejected all the claims as anticipated (35 U.S.C. §102) or obvious (35 U.S.C. §103) over cited art. Applicants traverse the prior art rejections and submit that all pending claims 1-33 are patentable over the cited art and in condition for allowance for the reasons discussed herein.

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REMARKS/ARGUMENTS

The Examiner rejected claims 1-9, 11, 12-20, 22, 24-31, and 33 as anticipated under 35 U.S.C. §102(e) by Bish (U.S. Patent No. 6,467,024). Applicants traverse for the following reasons.

Applicants submit that the anticipation rejection should be under 35 U.S.C. §102(a), not Section 102(e), because the Bish patent issued before the present application was filed.

Independent claims 1, 12, and 23 concern forming a consistency group of data, and require: receiving a command to form a consistency group with respect to data received at a first storage site that is mirrored to a second storage site; providing a first data structure indicating updates to the first storage site not included in the consistency group that are received after the command; providing a second data structure indicating updates to the first storage site in the consistency group to be formed; transmitting a command to cause data copied to the second storage site that is part of the consistency group to be copied to a third storage site; receiving indication when the data in the second storage site that is part of the consistency group is copied to the third storage site.

Applicants note that the Examiner discussed claims 1, 12, and 24 as a group. Applicants believe the Examiner intended claim 23, because that is the independent claim in article of manufacture form, not claim 24. For this reason, Applicants reference and argue independent claims 1, 12, and 23 together.

The Examiner cited col. 5, lines 9-19 of Bish as disclosing the claim requirement of receiving a command to form a consistency group with respect to data received at a first storage site that is mirrored to a second storage site. (Office Action, pg. 2) Applicants traverse.

The cited col. 5 mentions that a library controller utilizes a database to track each data volume and the storage media on which it is stored to track the storage shelf location and each data volume in non-volatile fast cache and non-volatile cache. Although the cited col. 5 discusses tracking data for a library controller, nowhere is there any disclosure of the claim requirement of receiving a command to form a consistency group with respect to data received at a first storage site being mirrored to a second storage site.

The Examiner cited col. 7, lines 14-19, and col. 8, lines 29-34 of Bish as disclosing the claim requirement of providing a first data structure indicating updates to the first storage site not

included in the consistency group that are received after the command. (Office Action, p. 3)
Applicants traverse.

The cited col. 7 mentions that a director supplies each data volume from a host to all of the data storage libraries and updates each synchronization token associated with the supplied data so that the libraries store duplicate copies of the data. The synchronization token indicates the relative updates levels of the associated redundant copies. (Bish, col. 3, lines 1-8).

The cited col. 7 nowhere discloses a first data structure indicating updates to the first storage site not included in the consistency group that are received after the command to form the consistency group. Instead, the cited col. 7 mentions supplying updates from a host to data storage libraries, but nowhere discloses indicating updates not included the consistency group that are received after the consistency group is formed.

The cited col. 8 mentions tables for libraries in a database, where each table relates the data volume to the synchronization token to store and maintain the synchronization token. Although the cited col. 8 mentions relating a synchronization token indicating update levels with a data volume, nowhere does the cited col. 8 anywhere disclose the claim requirement of indicating updates not included the consistency group that are received after the consistency group is formed.

There is no disclosure in the cited cols. 7 and 8 of indicating updates not included in the consistency group as claimed. Instead, the cited cols. 7 and 8 discuss how data volumes are supplied to storage libraries.

The Examiner cited the above discussed cols. 7 and 8 as disclosing the claim requirement of providing a second data structure indicating updates to the first storage site in the consistency group to be formed. (Office Action, p. 3) Applicants traverse.

The cited cols. 7-8 nowhere disclose indicating updates to the first storage site in the consistency group to be formed. Instead, the cited cols. 7-8 discuss how a data volume is supplied to data storage libraries and a token associated with the data volume is maintained.

The Examiner cited col. 6, lines 1-4 and 24-29 as disclosing the claim requirement of transmitting a command to cause data copied to the second storage site that is part of the consistency group to be copied to a third storage site. (Office Action, p. 3) Applicants traverse.

The cited col. 6 mentions that a data volume in cache storage may be accessed or a received data volume may be quickly transferred to the library cache storage. Further, the

migration from cache to backing storage may be directly to either drives 34 or 35, or migration may continue with the data first migrated to backing storage at one of the drives and then migrated to another part of the backing storage at drives 35.

Although the cited col. 6 discusses transferring data from a cache storage to drives, nowhere does the cited col. 6 anywhere disclose the claim requirement of transmitting a command to cause data that is part of the consistency group to be copied from second to third storage. Nowhere is there any disclosure in the cited Bish of transmitting commands to copy data that is part of a consistency group between three storage sites.

The Examiner cited col. 8, lines 1-9 of Bish as disclosing the claim requirement of receiving indication when the data in the second storage site that is part of the consistency group is copied to the third storage site. (Office Action, p. 3) Applicants traverse.

The cited col. 8 mentions that the library controller of each data storage library attaches a cache flag to the synchronization token for each of the data volumes upon being stored in the cache storage. The library controller identifies the cache storage of the data volume and changes the cache flag as the data is migrated to the backing storage.

Although the cited col. 8 discusses a flag indicating whether a data volume has been migrated, nowhere does the cited col. 8 disclose receiving indication when data in a second storage site part of a consistency group of updates from a first storage site are copied to a third storage site.

Accordingly, claims 1, 12, and 23 are patentable over the cited art because the cited Bish does not disclose all the requirements of the claims.

Claims 2-9, 11, 13-20, 22, 24-31, and 33 are patentable over the cited art because they depend from claims 1, 12, and 24, which are patentable over the cited art for the reasons discussed above. Moreover, the following dependent claims provide additional grounds of patentability over the cited art.

Claims 2, 13, and 24 depend from claims 1, 12, and 23 and further require maintaining a flag indicating which of the first and second data structures to use to indicate updates received after the command to form the consistency group; and toggling the flag to indicate the data structure not currently indicated by the flag, wherein the flag identifies the data structure that indicates updates to the first storage site not included in the consistency group.

The Examiner cited col. 8, lines 1-9 and 26-34 as disclosing the additional requirements of these claims. (Office Action, p. 3) Applicants traverse for the following reasons.

The cited col. 8 mentions that the library controller of each data storage library attaches a cache flag to the synchronization token for each of the data volumes upon being stored in the cache storage. The library controller identifies the cache storage of the data volume and changes the cache flag as the data is migrated to the backing storage.

The cited lines 26-34 mention that an indicator is a flag of bits in a location in a table. The tables 61 and 62 are for each of the libraries 1 and 2. Each table relates the data volume to the synchronization token.

The cited col. 8 discusses a flag for a synchronization token upon the data volume being stored in the cache. Nowhere does this disclose the claim requirement of a flag indicating which of the first and second data structures to use to indicate updates received after the command to form the consistency group. There is no disclosure or mention in the cited col. 8 of a data structure indicating updates received after the command to form the consistency group.

Further, nowhere does the cited col. 8 disclose or mention that the flag identifies the data structure that indicates updates to the first storage site not included in the consistency group. Instead, the cited col. 8 discusses a synchronization token for each data volume, where the synchronization token indicates the relative update levels of the data volume, and a cache flag that is changed as the data volume is migrated to the backing storage.

Accordingly, claims 2, 13, and 24 provide additional grounds of patentability over the cited art because the additional requirements of these claims are not disclosed in the cited Bish.

Claims 3, 14, and 25 depend from claims 1, 12, and 23, respectively, and further require detecting a failure at the second storage site; determining whether the data in the consistency group was copied to the third storage site; and copying the updates at the first storage site indicated in the first data structure to the third storage site after determining that the data in the consistency group was copied to the third storage site.

The Examiner cited col. 8, lines 13-22 of Bish as disclosing the additional requirements of these claims. (Office Action, p. 4) Applicants traverse.

The cited col. 8 mentions that a director, in forwarding a recall request from the hosts for data volumes in the data storage libraries, requests the associated synchronization token from each library. Each data storage library responds to a recall request for one of the redundant

copies of the identifiable data volumes, providing with the synchronization token associated with the data volume an indicator indicating whether the data is identified as currently stored in the cache storage or backing storage.

Nowhere does the cited col. 8 anywhere disclose copying updates at a first storage site indicated in the first data structure to the third storage site after determining that the data in the consistency group was copied to the third storage site. Instead, the cited col. 8 discusses recalling a data volume, not copying updates from a first storage site to a third storage site after a failure at the second storage site.

Accordingly, claims 3, 14, and 25 provide additional grounds of patentability over the cited art because the additional requirements of these claims are not disclosed in the cited Bish.

Claims 4, 15, and 26 depend from claims 3, 14, and 25 and further require copying the data at the first storage site indicated in the first and second data structures to the third storage site after determining that the data in the consistency group was not copied to the third storage site.

The Examiner cited col. 8, lines 45-50 of Bish as disclosing the additional requirements of these claims. (Office Action, p. 4) Applicants traverse.

The cited col. 8 mentions that the library having the data volume with the most current synchronization token will be selected for providing the data volume, and the attached cache flags will not be considered.

Nowhere does the cited col. 8 anywhere disclose or mention copying data at a first storage site indicated in first and second data structures (indicating updates to the first storage not included in the consistency group and updates in the consistency group) to the third storage site after determining that the data was not copied to the third site. Instead, the cited col. 8 discusses how to select the most current data volume to provide.

Accordingly, claims 4, 15, and 26 provide additional grounds of patentability over the cited art because the additional requirements of these claims are not disclosed in the cited Bish.

Claims 5, 16, and 27 depend from claims 4, 15, and 26 and further require merging data indicated in the first and second data structures into one of the data structures to indicate data in the consistency group that needs to be copied to the third site, wherein the other of the data structures is used to indicate updates to data that is not in the consistency group.

The Examiner cited col. 10, lines 56-65 as disclosing the additional requirements of these claims. (Office Action, pg. 4) Applicants traverse. The cited col. 10 mentions that upon a director receiving a request for a data volume, the director requests a synchronization token and the library reads the token and cache flag for the data volume.

Nowhere does this cited col. 10 anywhere disclose or mention merging data from data structures indicating updates to the first storage not included in the consistency group and updates in the consistency group.

Accordingly, claims 5, 16, and 27 provide additional grounds of patentability over the cited art because the additional requirements of these claims are not disclosed in the cited Bish.

Independent claims 8, 19, and 30 concern forming a consistency group of updates received at a first storage site, and require: receiving at a second storage site updates from the first storage site; providing a first data structure indicating updates at the second storage site to copy to a third storage site; receiving a command to form a consistency group; using a second data structure at the second storage site to indicate updates received from the first storage site after receiving the command that are not included in the consistency group to be formed; and signaling the first storage site in response to copying the updates in the consistency group indicated in the first data structure to a third storage site.

The Examiner cited col. 7, lines 14-19 and col. 8, lines 28-34 of Bish as disclosing the claim requirement of providing a first data structure indicating updates at the second storage site to copy to a third storage site. (Office Action, p. 5) Applicants traverse.

The cited col. 7 mentions that a director supplies each data volume from a host to all of the data storage libraries and updates each synchronization token associated with the supplied data so that the libraries store duplicate copies of the data. The synchronization token indicates the relative updates levels of the associated redundant copies. (Bish, col. 3, lines 1-8).

The cited col. 7 nowhere discloses a first data structure indicating updates to the second storage site received from a first storage site to copy to a third storage site. Instead, the cited col. 7 mentions supplying updates from a host to data storage libraries, but nowhere discloses indicating updates from a first storage site at the second storage site to copy to a third storage site as claimed.

The cited col. 8 mentions tables for libraries in a database, where each table relates the data volume to the synchronization token to store and maintain the synchronization token.

Although the cited col. 8 mentions relating a synchronization token indicating update levels with a data volume, nowhere does the cited col. 8 anywhere disclose the claim requirement of indicating updates from a first storage site at the second storage site to copy to a third storage site as claimed.

There is no disclosure in the cited cols. 7 and 8 of indicating updates from a first storage site at the second storage site to copy to a third storage site as claimed. Instead, the cited cols. 7 and 8 discuss how data volumes are supplied to storage libraries.

The Examiner cited col. 5, lines 9-19, col. 7, lines 14-19 and col. 8, lines 28-34 of Bish as disclosing the claim requirements of receiving a command to form a consistency group and using a second data structure at the second storage site to indicate updates received from the first storage site after receiving the command that are not included in the consistency group to be formed. (Office Action, p. 6) Applicants traverse.

The cited col. 5 mentions that a library controller utilizes a database to track each data volume and the storage media on which it is stored to track the storage shelf location and each data volume in non-volatile fast cache and non-volatile cache. Although the cited col. 5 discusses tracking data for a library controller, nowhere is there any disclosure of the claim requirement of receiving a command to form a consistency group and then using a second data structure to indicate updates received after receiving the command that are not included in the consistency group.

The cited cols. 7 and 8 discuss how data volumes are supplied to storage libraries. Nowhere do the cited cols. 7 and 8 disclose indicating updates not included in the consistency group as claimed.

Accordingly, claims 8, 19, and 30 are patentable over the cited art because the cited Bish does not disclose all the requirements of the claims.

Claims 9, 20, and 31 depend from claims 8, 19, and 30 and further recite merging indications of updates in the first and second data structures into the first data structure in response to copying the updates in the consistency group indicated in the first data structure to the third storage site; and indicating in the second data structure updates from the first storage site received after merging the first and second data structure.

The Examiner cited col. 10, lines 56-65 as disclosing the additional requirements of these claims. (Office Action, p. 6) Applicants traverse.

The cited col. 10 mentions that upon a directory receiving a request for a data volume, the directory requests a synchronization token and the library reads the token and cache flag for the data volume.

Nowhere does this cited col. 10 anywhere disclose or mention merging data from a first data structure indicating updates at the second storage site to copy to a third storage site and a second data structure indicating updates received from the first storage site after receiving the command that are not included in the consistency group. Nowhere does the cited col. 10 anywhere disclose merging data from such different data structures as claimed.

Accordingly, claims 9, 20, and 31 provide additional grounds of patentability over the cited art because the additional requirements of these claims are not disclosed in the cited Bish.

Claims 11, 22, and 33 depend from claims 8, 19, and 30 and further recite determining whether the second data structure is being used to indicate updates from the first storage site not in one consistency group in response to receiving the command to form the consistency group; merging indications of updates in the first and second data structures in the first data structure in response to receiving the command to form the consistency group and determining that the second data structure is being used to indicate updates from the first storage site not in one consistency group; and indicating in the second data structure updates from the first storage site received after merging the first and second data structure.

The Examiner cited previously discussed sections of Bish as disclosing the additional requirements of these claims. Applicants submit that there is no disclosure in the cited col. 10 of Bish of merging updates from a first data structure indicating updates at the second storage site to copy to a third storage site and a second data structure indicating updates received from the first storage site after receiving the command that are not included in the consistency group. There is no disclosure in the cited Bish of merging indications of updates from different data structures as claimed.

Accordingly, claims 9, 20, and 31 provide additional grounds of patentability over the cited art because the additional requirements of these claims are not disclosed in the cited Bish.

The Examiner rejected claims 10, 21, and 32 as obvious (35 U.S.C. §103(a)) over Bish in view of Kern (U.S. Patent No. 5,720,029). (Office Action, pg. 7) Applicants traverse on the grounds that claims 10, 21, and 32 are patentable over the cited art because they depend from

claims 8, 19, and 31, respectively, which are patentable over the cited art for the reasons discussed above.

Conclusion

For all the above reasons, Applicant submits that the pending claims 1-33 are patentable over the art of record. Applicants have not added any claims. Nonetheless, should any additional fees be required, please charge Deposit Account No. 09-0449.

The attorney of record invites the Examiner to contact him at (310) 553-7977 if the Examiner believes such contact would advance the prosecution of the case.

Dated: April 4, 2006

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